EMERGING TECHNOLOGIES

ENERGY↔WATER CONNECTION

Pumped Storage

Simple Changes – Big Savings

During the summer of 2000, Berrenda Mesa WD, Wheeler Ridge-Maricopa WSD, and Lost Hills WSD combined saved over $500,000 on electric energy charges. This was done by implementing various types of pumped storage systems. The idea behind pumped storage is not huge, but the savings are.

Harry Starkey, manager of Berrenda Mesa WD, stands next to the district's pumps. During 2000 this pumping station lifted 70,000 AF of water 227 feet to the district's buffer reservoir. Implementing a pumped storage system reduced the district's electricity cost by $350,000 per year.

Pumped storage uses some type of reservoir to store pumped water at a high elevation than the original water supply. During times of peak statewide electricity demand, pumping is reduced while water is withdrawn from the reservoir which acts as a buffer.

What Do Districts Need to Participate?

To implement this type of system, an irrigation district needs the following:

- A reservoir at a higher elevation than the district water supply. Ideally, the reservoir is at the head of the district's gravity canal. The reservoir must have the storage capacity needed to meet the deficit created by the reduction in pumping during peak electric load hours.
- Sufficient pumping capacity and water supply to refill the reservoir during off-peak hours.
- Ability to shut down and restart pumps when needed - either manually, remotely or automatically.

- Depending upon the arrangement with the utility, the utility may need to monitor electricity usage on 15 minute intervals.

Modified buffer reservoir at Berrenda Mesa WD. Raising the spillway 15 inches increased the reservoir's holding capacity from 90 AF to 130 AF. An additional 40 AF will be obtained through excavation.

The Storage Reservoir

Some districts - especially those whose supplies come from the California Aqueduct already have a storage reservoir. With a few modifications the storage capacity might be increased to sufficient levels. Examples include:

- A $50,000 modification to the spillway of Berrenda Mesa WD's reservoir increased its storage capacity from 90 acre-feet to 130 acre-feet. In 2001, the district received grant funding from the CEC (California Energy Commission) to expand its reservoir capacity an additional 40 acre-feet by excavating the reservoir. This will enable Berrenda Mesa WD to shed even more electric pumping load when necessary.
- Wheeler Ridge-Maricopa WSD was able to use its existing canal as a storage area for pumped water. Keeping the canal full gave them the buffer needed to reduce pumping by 0.3 megawatts during peak times.

- Lost Hills WSD modified its operation without making any hardware changes and has been able to reduce peak demands by 2-3 megawatts, earning $200,000 last year in savings. A one time investment of $500,000 to create an additional 50 acre-foot reservoir will increase the district's savings from $200,000 to an estimated $310,000 per year at year 2000 electricity rates. The district has received CEC grant funding to help fund the project.

Districts without existing reservoirs may be in geographical situations that would permit the installation of a storage reservoir. A quick economic analysis and check on pumping capacities will enable a district to determine what it would cost to implement such a scheme. The availability of loans or grants and the reduction in electricity charges, will then determine the economic viability of implementation.

The Operation

The specific arrangement to shed electric load will depend upon the contracting agencies. The two basic forms of arrangements are:

1. The district agrees to not pump part or all of its load during a set schedule. For example, the district might not pump during 4 critical hours/day, 5 days per week.
2. The district may agree to be "on call" to shed electric pumping load whenever the area or statewide electric grid nears capacity. A possible scenario may be this: A Demand Relief Program through ISO (Independent Systems Operator) may be set up so that districts curtail pumping only during stage II alerts. During an alert the ISO will contact the district via pager. When this happens, the district has thirty minutes to shed electricity usage by a pre-arranged amount from the districts' current 10-day running average of electricity use. The district personnel immediately inform the ISO if they are able to comply with the reduction. There are no penalties if districts are unable to comply fully, but the credits earned are reduced. Once the stage II alert has passed, district personnel are again informed via pager and they begin pumping at full capacity to refill the reservoir. There may be limits on how many hours the district is required to shed load.

Depending upon the starters and control systems used, the participating districts may need to carefully schedule personnel to be available to manually start or stop pumps. Records should also be kept to enable the district to deliberately

balance the amount of starts/stops between the various pumps.

When Will a Pumped Storage System Not Work?

Insufficient pumping capacity is a serious limitation in some districts. The addition or expansion of reservoirs may be easier to accomplish than the addition of pumps and penstocks between the pumps and reservoir.

Disadvantages

Possible disadvantages include:

- A change in the work schedule of various employees to accommodate the on/off operation of pumps.
- Additional wear and tear on pumps, motors, valves, and piping systems due to more frequent starting and stopping.

Advantages

Some advantages include:

- Significantly smaller energy costs than would be incurred without pumped storage.
- The shift may provide the impetus for a district to make upgrades to its pump control system. These upgrades can include the addition of
  - A SCADA (Supervisor Control and Data Acquisition) system that might include load monitoring and remote sensing of bearing temperatures, flow rates, and other items of interest.
  - Modernization of controls to include soft starts and variable speed drive controls that allow for remote or automatic starting and stopping.
  - Improved data management that comes along with a SCADA system. Access to real-time data that is well organized and archived allows the district to make better decisions on sequencing pumps and providing preventative maintenance.

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